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OBSERVATIONS OF EXTREMELY LOW FREQUENCY EMISSION AT  
TWO CONJUGATE POINTS

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ABSTRACT

This paper brings forth a few conclusions resulting from the combined Soviet-French investigations of extremely low frequency (elf) emissions at two magnetically conjugate points, of which the principal are that choruses, observed simultaneously at conjugate stations, are forerunners of impending negative ionospheric storms. During magnetoquiet days, no favorable conditions exist for the generation of elf in the Earth's exosphere when the outer magnetosphere boundary is situated at  $\sim 10R_E$ .

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The joint Soviet-French investigations on the observations of elf emission at the magnetically conjugate stations Sogra (Arkhangel'sk region) and Kergelen (French island in the Indian Ocean) were carried out simultaneously on identical apparatus, beginning from June 1964. The registration of elf emission at both stations is performed continuously on a paper recorder; a magnetophone parallel to the recorder was switched on during bursts of elf emission. Spectral analysis of magnetic tapes during the processing of visible readings helped to determine the type of elf emission.

The processing of visible readings for the period from June 1964 to March 1965 allowed to obtain certain new data concerning the properties of elf emission in the Kc frequency band. As a result of preliminary processing, three basic conclusions were obtained.

I. Simultaneous Observations at Two Conjugate Points

The properties of elf emissions, observed at the conjugate

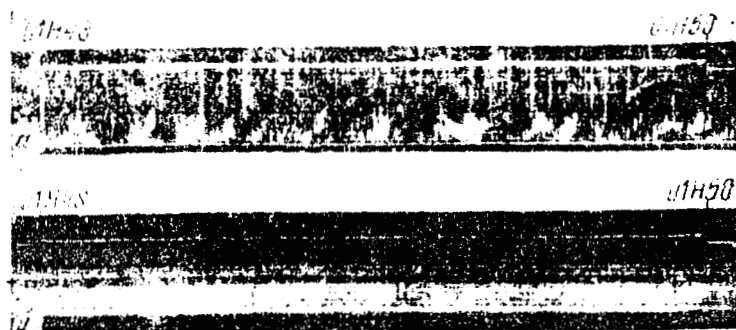


Figure 1

Choruses, 25 February 1965; a-Sogra, d-Kergelen

stations, are different depending upon the form of the emission (sibilant or chorus); moreover, the daily variations of these two phenomena are not identical [1]. Chorus emissions are very rarely observed simultaneously at both conjugate stations. (This does not concern the cases described in the following section.) Even during simultaneous appearance of choruses, the commencements and the terminations of the events do not usually coincide in time; the shape of the envelope and the burst amplitude are different. Nevertheless, spectral analysis showed (Figure 1) that the fine structure of choruses at the conjugate stations is identical; a similar phenomenon was already noted in work [2].

Contrary to choruses, hissing bursts (for the indicated period 38 cases of their appearances were noted) at conjugate points begin and end simultaneously. The shape of the envelope of the burst is identical and is of the same order (Figure 2) as the amplitude.

## 2. Relationship of Choruses with Ionospheric Storms

For the year from March 1964 to March 1965, 13 ionospheric storms along the Soviet network of ionospheric stations were observed with a drop in critical frequencies of the F<sub>2</sub>-layer from the sliding median to 30-50%. Observations of elf emission were conducted in 11 of the 13 cases, whereupon in 7 cases both conjugate stations were in operation and in the 4 remaining only one station, Sogra or Kergelen. In all of the 7 cases, choruses were perceptible at both working stations. Moreover, all 11 cases of choruses, forewarned the commencement of negative ionospheric storms by 14-18 hours and it can be concluded that the choruses, observed simultaneously at conjugate stations, are precursors of negative ionospheric storms.

On the other hand, 9 positive ionospheric storms were noted for the same year (see [3]) with an increase in critical frequencies of the F<sub>2</sub>-layer from the sliding median to 30-45%, but this type of storm was never attended by either choruses or sibilants. In addition, it was found that choruses audible only at one of the stations usually preceded the local drop in critical frequencies of the F<sub>2</sub>-layer by 8-15%.

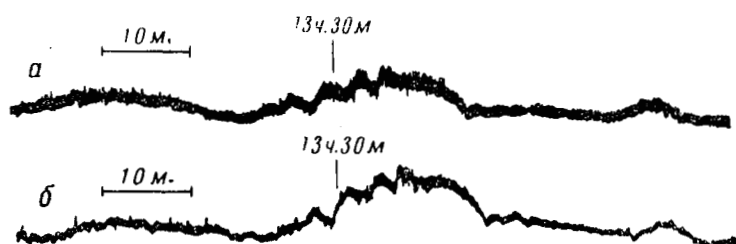


Figure 2

Sibilants, 17 September 1965, a-Sogra,  $\delta$ -Kergelen

### 3. Absence of ELF Emission during Magnetoquiet Periods

A correlation can be established between the disposition of the outer boundary of the magnetosphere and the appearance of elf emission. The comparison of the results obtained with the help of the satellite Electron-2 and the observed variation on the magnetic field on the surface of the Earth showed [4] that when the outer boundary of the magnetosphere is settled at the distance 10-11 Earth radii and sufficiently stable, the magnetic field at the ground is very quiet, during certain days in succession the sum  $K_p$  for a day does not rise above 12-15, while steady micro-pulsations Pc 4-5 with periods greater than 50 sec during terrestrial currents were noted.

Comparisons were made between the cases of elf emission appearance at Sogra and Kergelen and the magnetoquiet periods according to  $K_p$  and the observation data of the magnetic field in Kergelen, kindly provided for us by R. Shlishem (France). According to these data, forty-one cases of undisturbed days were registered for 10 months from March to December 1964, when steady micro-pulsations with periods greater than 50 sec were observed. In these days not a single case of the sibilant type emission appearance was detected and only one case of very weak chorus was recorded.

Thus, a conclusion can be made that in magnetoquiet days, when the outer boundary of the magnetosphere is disposed at the distance of approximately 10 Earth radii, no favorable conditions for the generation of elf emission are created in the exosphere of the Earth.

\* \* \* T H E      E N D \* \* \*

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